

Urban runoff – Flowing down storm drains and into California waters

By Linda Dailey Paulson

The sky forms a low, solid blanket along the coast. The dreary day is might be safe to resume their favorite sport. At least one bemoans nursing a persistent earache. Rainy or dry, the waters that feed the ocean are increasingly awash with chemical and biological contaminants thanks to urban runoff.

Urban runoff has been exacerbated as more and punctuated by cloudbursts that have sent surfers into cafes to discuss when it more development takes place, tributaries are diverted, and less open space exists. Without open areas acting as both sponge and filter, water courses freely over blacktop and cement, picking up impurities en route to the nearest tributary.

California has 1,264 miles of beaches and harbors and hundreds of inland waterways and groundwater, all threatened by urban runoff.

“More water is draining down to the beach and it’s getting there a lot quicker,” says Chad Nelsen of the Surfrider Foundation. Rivers such as the Los Angeles and San Gabriel are lined, making them giant storm drains.

The term “urban runoff” is a broad term, says Lt. Paul Hamilton, a warden with Department of Fish and Game’s (DFG) Office of Spill Prevention Response. It generally refers to substances from specific spills — accidental or intentional — rather than runoff caused by rain, which is typically called storm runoff. The two terms are frequently interchanged since the net impact is similar.

What’s in the water runs the gamut, said Hamilton. This includes petroleum products from poorly maintained cars or gas station equipment and used kitty litter, or trash thrown down a storm drain. Arsenic and

cadmium from substances including normal tire wear left behind on road surfaces is also found in runoff as are bacteria and other potentially infectious organisms. Other pollutants of great concern include nutrients from fertilizers and pesticides used around the home. Dumping substances into storm drains is illegal, and yet storm drains are commonly used as receptacles for yard debris, soapy water, solvents, and other refuse.

“Anything we use with water outside our homes has an effect on the bacterial population of the water,” said Mike Rugg, staff scientist for the DFG’s Central Coast Region water quality lab. Dog and cat feces, for example, are 40 times more harmful to a creek than an equal amount of treated human sewage. Seemingly harmless compost piles near a creek leach nutrients and other oxygen-demanding materials into the water which upset the creek’s delicate natural balance. These cumulative effects are best seen after a heavy rain when effluent-filled drains disgorge trash and polluted storm water into the bays or oceans. This “big flush” forces many beach closures.

A frequently repeated maxim contends “dilution is the solution to water pollution.” Not true say state scientists. Many household products cannot be diluted enough to render them sufficiently harmless.

Most are toxic to fish and aquatic life, and should not be allowed to runoff. Product advertisements tout different substances as being non-toxic and biodegradable. Yet, these advertisements fail to mention that the toxicity of which they speak relates to the product’s toxicity to the user; and its biodegradability refers to the product’s ability to be broken down through biological

processes in an appropriately designed and operated sewage treatment system.

Some household detergents and cleaning products would need to be diluted with at least 10,000 parts water to one part chemical “to make them non-toxic through dilution alone,” said Rugg. Few of California’s local streams have that much dilution available following agricultural and municipal diversion.

“There’s no sustained flow. There’s nothing left to take care of that small amount we can’t treat,” says Rugg. “We have such a large impact on the environment just from our being here.” Even if adequate water were available, it would still take weeks for that toxic substance to “biodegrade” or become environmentally benign. For this reason, any discharge into gutters, storm drains or creeks should be non-toxic, said Rugg. Many organisms’ lifecycles are relatively short, so toxins have an immediate aquatic ecosystem impact.

“A surprise to many of us is the toxicity of some of the consumer products we use,” says Rugg. “We have been led to believe they are nontoxic.”

Although many products claim to be more biodegradable, they are still of environmental concern. “Pool dumps” are another big problem. Chlorine and other chemicals in pool water drained into gutters or siphoned into storm drains can wreak ecological havoc.

In addition to man-made pollutants, other materials can be detrimental to the environment. Hamilton believes siltation is one of the most egregious pollutants. Silt discharges come from erosion from timber harvesting, construction, and streambed alterations including vegetation removal. There are laws that require containment and retention of sediment-laden discharges, but in many instances they are not well enforced.

“Talk to the biologist,” says Hamilton. “Nothing shuts down a waterway more than siltation.”

“Sedimentation has a major, adverse impact on the kelp,” says Dennis Bedford, a DFG associate marine biologist involved with kelp management and monitoring. Bedford notes that kelp has two distinct stages. The one we see and refer to as kelp is just the sporophyte stage. Spores produced by this stage settle to the bottom and give rise to microscopic male and female plants called gametophytes. The sperm and eggs from these tiny gametophytes produce the next generation of giant sporophyte plants.

“The microscopic gametophytes manifest kelp’s real vulnerability,” said Bedford. “If you have a lot of sedimentation, they can be buried or have no place to attach. If the gametophyte stage fails, there can be no new giant sporophytes. Kelp plays a vital role in the reproduction, protection and nourishment of fishes and invertebrate species.”

As such, kelp health is essential. Kelp beds have vanished around Los Angeles due in part to dredging and/ or treatment plant outfalls.

“It’s no good to transplant it,” Bedford says. “If the conditions were right, it would reestablish itself. There’s no lack of kelp. There is something wrong with the conditions.” Those conditions include urban development and pollution.

Beach closures are another urban runoff by-product. These not only sadden surfers, they affect local economies. According to Heal the Bay, “storm drain runoff continues as the largest source of pollution to local beaches. . . .” The recently released *2002-2003 Annual Beach Report Card* states “that most beaches had very good water quality, with 205 of 298 (69 percent) locations receiving A grades for the year during dry weather. . . . There were a handful

of water quality success stories throughout the state this past summer.” This includes three beaches whose water quality significantly improved: Arroyo Quemada in Santa Barbara; Malibu Surfrider Beach, still on the organization’s “Bummer” list, but rating an “A” between April and October; and Avalon Beach on Catalina Island. San Diego, Orange, Sonoma, Santa Cruz, Santa Barbara, and Los Angeles counties had beaches ranking in the top 10 worst, according to the report.

Surfrider Foundation says their organization constantly receives reports from sick surfers, according to Nelsen, environmental director. Commonly reported ailments include ear-nose-throat infections, but other illnesses are more difficult to pinpoint with symptoms similar to food poisoning. The good news, said Nelsen, is that water quality monitoring and reporting in California is “the best in the nation.” Although dry weather is better for beachgoers’ health, the organization notes popular beaches including Malibu Surfrider and Doheny, located in Orange County, are unsafe due to poor water quality.

Often the greatest problems are in areas where storm drains are located or the water body has poor water circulation. If these waters are unsafe for human recreation, what happens to the vertebrates and invertebrates for which these waters are home? Pathogens entering the ocean waters through urban runoff are causing alarming problems in sea life from the large mammals to the microscopic invertebrates.

Dr. Melissa Miller, a pathologist from the U.C. Davis Wildlife Health Center, and Dr. David Jessup, DFG senior wildlife veterinarian, are studying two parasites that are infecting sea otters. *Toxoplasma gondii* and *sarcocystis eneurona* are parasites found in cats and opossums respectively, both of which are introduced species found in urban areas. Sea otters near areas of maximal freshwater inputs into the ocean are three times more likely to get

toxoplasmosis. Some have died from the infection. The incidence is greatly increased in areas such as Morro Bay and Elkhorn Slough. Shellfish may be another infection source. Dr. Patricia Conrad and her graduate students at U.C. Davis, and Dr. Kristen Arkush of the U.C. Davis Bodega Marine Lab are examining how these parasites can become concentrated in bivalves.

“This is the logical route by which the organisms can enter the ocean species,” says Jessup. “Otters eat them. People eat them, too.” This contamination is “potentially a greater problem because [bivalves] concentrate the contaminants and are themselves a food item for otters which might ingest them.... Sea otters are useful as a sentinel species. Other species may be getting infected and this may be a source of infection to people.”

Jessup and Miller have also found that in some areas of the Central Coast where sewage spills have occurred repeatedly, bacterial and protozoal organisms usually associated with intestinal disease in people and other animals can be found in sea otter feces. They found evidence of infection by seven of the eight organisms they looked for, and infection with more than one of these organisms in 35 percent of the animals tested. Recently, the State Water Quality Control Board decided to fund expansion of this research.

Pollution obviously causes a ripple effect throughout the aquatic ecosystem, starting with zooplankton such as rotifers, favored foods for larval fish. Research being conducted by the Georgia Tech School of Biology is determining how pollution may change these tiny creatures’ life cycle, including the possibility that contaminants may disrupt mating. Thus far, they found toxins do affect other facets of rotifer reproduction. This is exceedingly important as rotifers have limited reproductive capability. Male zooplankton produce only 30 sperm during their lifecycle. The affect of

urban runoff pollutants on the planktonic community is just starting to be investigated. However early research does point to detrimental effects.

So how does society try and cope with this tremendous problem? It is everyone's responsibility to keep foreign substances out of the state's water. "That's our only recourse," says Rugg.

In order to more effectively address adverse effects caused by urban runoff, the State Water Resources Control Board and the nine Regional Water Quality Control Boards have issued a number of permits that in essence regulate these types of discharges. The permits are federal permits called National Pollutant Discharge Elimination System (NPDES) and the authority to issue these permits have been granted to the State. The NPDES permits regulate discharges from municipalities (storm drains), industrial sites and construction sites.

As an example, the San Diego Regional Board has issued a municipal NPDES stormwater permit that is very comprehensive. It targets both low-flow discharges (urban runoff) as well as stormwater discharges and requires the various entities to develop and implement Best Management Practices (BMPs). The BMPs address things like source control, public education, treatment strategies, street cleaning programs and a whole host of other practices aimed at reducing the pollutant load to the states waterways. Structural control measures have also been utilized in San Diego. The City of San Diego constructed a diversion system around Mission Bay that diverts low-flow urban runoff into the sewer system and thus removes that source of pollution. Ultimately the program's success hinges on the participation by cities, industries, and the general public.

Hamilton says nothing helps water quality more than simple changes in

behavior. This means disposing of solvents and soaps correctly, and preventing runoff from lawns and sweeping instead of hosing off sidewalks.

Creating cleaner water begins at the top of the food chain with humans changing their behaviors, but engineers and scientists are looking at the bottom of the food chain to see if microbes can help by a process known as bioremediation. Bioremediation uses introduced or naturally existing organisms to help clean up the environment. Until then, California law, specifically Proposition 40, targets watershed and beach clean up with \$375 million in funding allocated for these state projects.

"We still have a long way to go in educating people and in protecting the water we do have left," said Rugg, but it is a start.

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